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LONG DATABASE REPORT NEOTROPICAL VEGETATION

ArgVeg – Database of Central Argentina

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Abstract

The ArgVeg is a repository of vegetation-plots data registered in the Global Index of Vegetation Databases (GIVD ID: SA-AR-002). This report presents its main characteristics, potential uses, and future perspectives. In September 2022, the database contained 1092 vegetation-plot records, including 1184 valid native and non-native vascular plants. The database covers the main vegetation types of nine vegetation units of the Chaco, Espinal and Pampean phytogeographic provinces in central Argentina. Those types include native forests, shrublands, grasslands, halophytic vegetation and non-native woody communities present in either lowlands or mountain areas. This database represents a significant improvement in the availability of floristic information from subtropical and warm temperate areas in South America, which still represents a major knowledge gap worldwide. ArgVeg reflects the outstanding plant diversity of central Argentina and it is managed by the Plant Ecology and Phytogeography Group at the Multidisciplinary Institute of Plant Biology (Córdoba, Argentina). Not only the high biodiversity but also the complex landscape heterogeneity are the most important characteristics of the vegetation in this region. We hope to increase the number of plots in the near future and to strengthen regional and global networks to enhance the conservation and management of these endangered ecosystems.

Keywords

Argentina, forest, grassland, seasonally dry ecosystem, shrubland, South America, sPlot

GIVD Fact Sheet: ArgVeg – Database of Central Argentina

GIVD Database ID: SA-AR-002			
ArgVeg – Database of Central Argentina		**Web address:**	
Database manager(s): Melisa Giorgis (mgiorgis@imbiv.unc.edu.ar); Alicia T.R. Acosta (acosta@uniroma3.it)			
Owner: Melisa A. Giorgis			
Scope: The database includes published and original phytosociological floristic surveys (most of them georeferenced) conducted on Subtropical seasonally dry plant communities from the southern extreme of the Great Chaco and Espinal forests. Currently, the database comprises the province of Córdoba located in central Argentina covering ca. 161 000 km². The scope was to compile in a single database the existing data on floristic composition and physiognomy of the major vegetation types in central Argentina for the first time.			
Abstract: The database contains floristic surveys representing the geographical, topographical and ecological variation found in subtropical seasonally dry Chaco and xerophytic Espinal forests while few plots are located in the Pampas grassland. The main semi-natural physiognomies are covered as well as Pinus plantations and patches invaded by woody non-native species.			
Availability: according to a specific agreement		**Online upload:** no	**Online search:** no
Database format(s): TURBOVEG, Excel		**Export format(s):** Excel	
Plot type(s): normal plots		**Plot-size range (m²):** 25 to 500	
Non-overlapping plots: 1092	**Estimate of existing plots:** 1500	**Completeness:** 73%	**Status:** ongoing capture
Total no. of plot observations: 1092	**Number of sources (biblioreferences, data collectors):** 2		**Valid taxa:** 1184
Countries (%): AR: 100			
Formations: Forest: 23% = Terrestrial: 23% // Non Forest: 72% = Terrestrial: 72% (Non arctic-alpin: 72% [Semi-natural: 72%])			
Guilds: all vascular plants: 100%			
Environmental data (%): altitude: 100			
Performance measure(s): cover: 100%			
Geographic localisation: GPS coordinates (precision 25 m or less): 77%; point coordinates less precise than GPS, up to 1 km: 23%			
Sampling periods: 1980-1989: 6%; 1990-1999: 10.7%; 2000-2009: 65%; 2010-2019: 18.4%			
Information as of 2022-11-22; further details and future updates available from http://www.givd.info/ID/SA-AR-002			

Introduction

In the last century, millions of vegetation plots have been recorded around the world for different purposes, as well as a huge amount of associated environmental information (Sabatini et al. 2021). However, most of these vegetation plots are located in Europe where there is a long tradition in vegetation studies based on the classical phytosociological approach (Dengler et al. 2011). This approach has proven to be a very useful methodological framework for local and regional overviews of vegetation types (Schaminée et al. 2009). In North America and Australia there are also thousands of relevés, however, according to the Global Index of Vegetation-Plot Databases (GIVD), South America and Africa are the continents less represented (Sabatini et al. 2021).

Access to vegetation plot information at regional and global scales was extremely limited prior to the advent of electronic database technologies and digital communication tools (Dengler et al. 2011). In Argentina, large amounts of floristic surveys have been performed (Martinez-Carretero et al. 2016), although most of this information is often unpublished or included in "grey literature" not yet widely available on digital archives. The compilation of a national vegetation-plot database is particularly urgent for Argentinian plant communities which are currently highly threatened (Piquer-Rodríguez et al. 2018). In particular, the large diversity of central Argentina vegetation is extensively recognised (Oyarzabal et al. 2018), but it is in danger not only because of the advance of the agricultural frontier (Hoyos et al. 2013; Agost 2015; Fehlenberg et al. 2017; Muñoz Garachana et al. 2018), but also due to the spread of non-native species and increasing urbanization (Zeballos et al. 2020; Giorgis et al. 2021; Cingolani et al. 2022).

On such a basis we compiled a vegetation database of central Argentina (ArgVeg) by collecting published and unpublished floristic information and georeferencing each vegetation plot. In particular, we focused on the spatial distribution of the different plant communities based on the information available in the database. In this report we aim to 1) increase the visibility of the ArgVeg database containing detailed floristic information of a relatively unknown region of the world, and 2) present its main features and applications.

Database compilation

The ArgVeg started in 2017 with a number of vegetation plots published in Acosta et al. (1991) and Cabido et al. (1994). In 2019 with the inclusion of further plots published in Giorgis et al. (2017) and other unpublished surveys, the database comprised 819 surveys. Currently, it encompasses a total of 1092 plots and the last update included new surveys published in Zeballos et al. (2020), Giorgis et al. (2021), and other unpublished data.

The inconsistency of the abundances of species recorded with different scales was handled by transforming all data into a cover (%) scale. In general, vegetation surveys were originally obtained using a continuous scale (see Giorgis et al. 2017), but sometimes the Braun-Blanquet scale was followed (i.e. Acosta et al. 1991). In most cases, geo-referencing was obtained in the field with a GPS. In

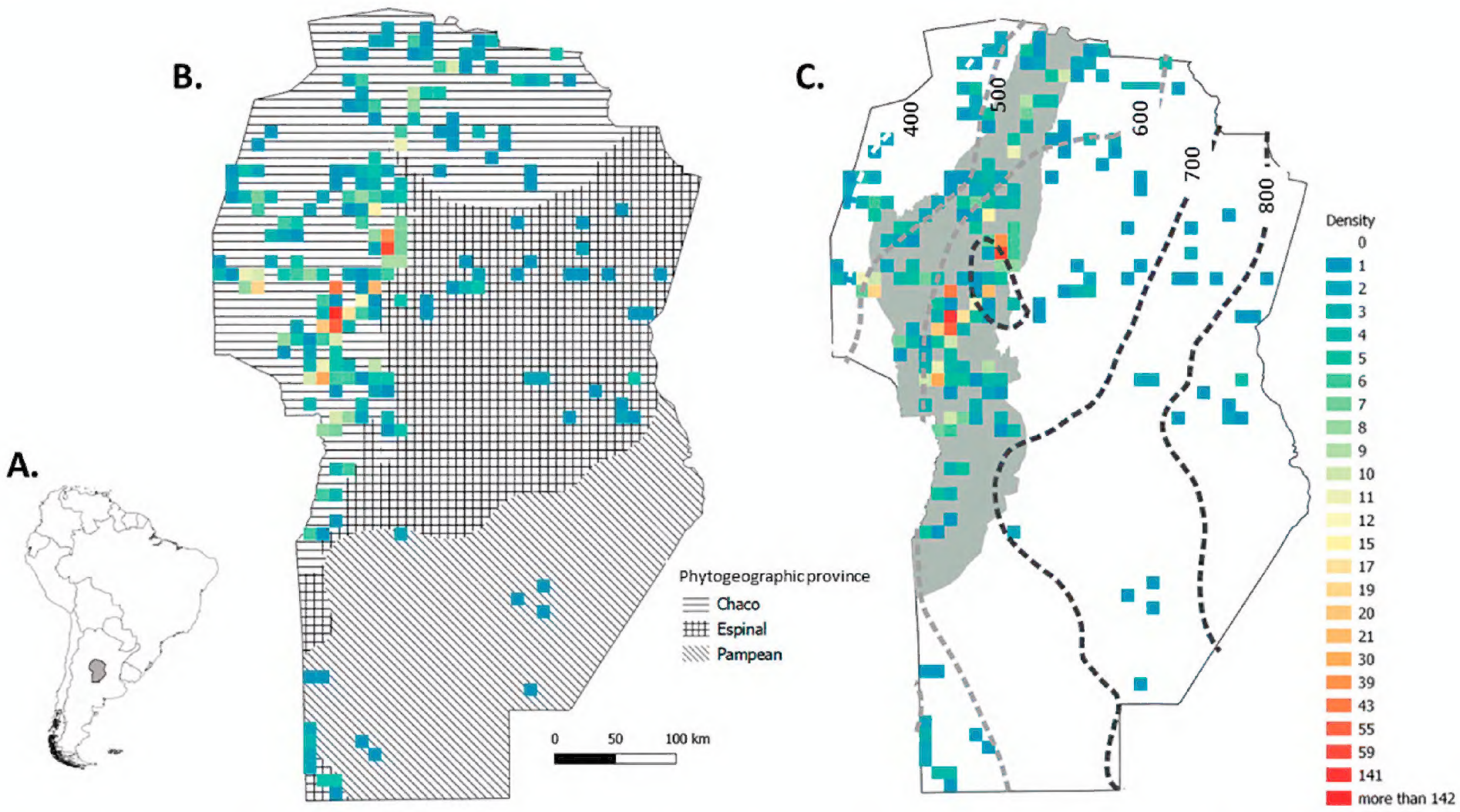

Figure 1. Location of Córdoba province in Argentina and South America (A). Density grid map showing the number of vegetation plots located in the different phytogeographic provinces (based on Oyarzabal et al. 2018) (B) and in plains (white) and mountains (grey) with dotted lines joining points with the same annual precipitation (C) of Córdoba province. Legend for the colour code is the same for (B) and (C).

oldest plots, this information was assumed through locality descriptions and proximity to other geo-referenced plots, however this approach was not possible in a few cases (6 out of 1092). Species names were harmonized in September 2022 using the Taxonomic Name Resolution Service (Boyle et al. 2021) online tool (https://tnrs.bien-data.org/) with default settings.

Data accessibility

ArgVeg is managed by the Plant Ecology and Phytogeography Research Group at the Multidisciplinary Institute of Plant Biology (Córdoba, Argentina), and most plots are included in the sPlot database (Bruelheide et al. 2019). The database can be requested via sPlot or directly from the database custodian (first author of this article). The ArgVeg is an independent database and data remains in the ownership of the data contributors. Decisions on data sharing will be made individually for each data request. Finally, we should note that ArgVeg is related to different ongoing research projects so the database is under constant development.

Content of the database

The ArgVeg includes 1,092 vegetation plots from central Argentina (Fig. 1A). The oldest plot in the database was dated in 1989, although most of the data (84%) were performed from 2004 to 2019. Sampling size vary from 9 to 400 m^2, but in most cases sampling plots are about 400 m^2 (72%), followed by 16 m^2 (20%) and 100 m^2 6%). Biggest plots with 400 m^2 include different physiognomic types while small plots correspond to grasslands, grazing lawns, and outcrops.

Vegetation plots comprised in the database are located in Córdoba province, which includes three phytogeographic provinces characterised by a subtropical seasonally dry climate including a precipitation gradient from 900 mm yr^{-1} in the southeast to 450 mm yr^{-1} in the northwest (see Fig. 1B, C). Plots were distributed across the three phytogeographic provinces (Table 1), but the largest proportion were located in the Chaco phytogeographic province, in particular in mountain areas (i.e. Mountain Chaco and Sub-Andean units) (Fig. 1C). This concentration in the spatial distribution of the plots is related to the fact that most Pampean and Espinal vegetation has been replaced by crops (Zak et al. 2019; Zeballos et al. 2020), and thus only small areas of natural and semi-natural vegetation still remain in these units (Cabido et al. 2018; Zak et al. 2019; Giorgis et al. 2021). The criteria for field plot locations depend on each project (see reference in Table 1), but in all cases the main physiognomies of those vegetation units are represented by a large number of floristic surveys.

The database now includes 1,184 specific and infraspecific taxa (see Fig. 2), which represent 54% of the vascular plants registered in Córdoba province (Zuloaga et al. 2019), and covers the main vegetation units of the Chaco, Espinal and Pampean phytogeographic provinces in central Argentina described by Oyarzabal et al. (2018) (Fig. 3).

Table 1. Number of floristic surveys across the phytogeographic divisions of the study area based on Oyarzabal et al. (2018). In brackets is the area covered (km²) by each unit in Córdoba province. Names of vegetation units were modified from Oyarzabal et al. (2018).

Phytogeographic province	Vegetation unit	Number of plots (vegetation unit area km²)	Published articles
Chaco		995 (394,148)	
	Arid Chaco	70 (98,024)	Cabido et al. 1994, 2018
	Semi-Arid Chaco	53 (238,395)	Cabido et al. 2018
	Mountain Chaco	527 (35,536)	Cabido et al. 1994, 2018; Giorgis et al. 2017, 2021; Zeballos et al. 2021
	Sub-Andean	332 (5,287)	Giorgis et al. 2017, 2021; Cabido et al. 2018
	Halophytic vegetation	13 (16,906)	Cabido et al. 2018
Espinal		79 (144,581)	
	Southern Espinal	10 (67,250)	Zeballos et al.2020
	Central Espinal	69 (77,331)	Zeballos et al. 2020
Pampean		18 (243,024)	
	Flat Interior Pampa	4 (84,812)	Unpublished
	Western Interior Pampa	4 (90,237)	Unpublished
	Ondulate Pampa	0 (67,975)	–

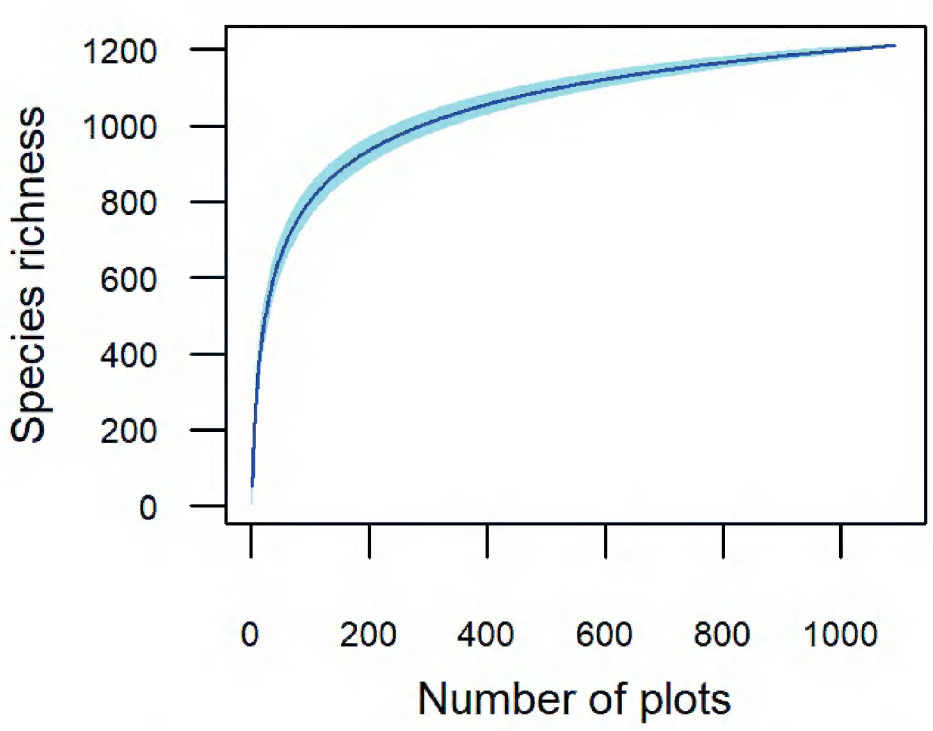

Figure 2. Species accumulation curve for the 1092 floristic surveys of the ArgVeg database.

A brief description of these units and related published articles follows below (see Table 1 for all references).

1. **Chaco.** This phytogeographic province is located in the north and western parts of the Córdoba province with forests and savannas as potential vegetation (Oyarzabal et al. 2018). Their floristic composition and physiognomy, as well as human activities, are driven by the decreasing precipitation gradient from the east to the west. The woody vegetation types of this part of the Chaco are described in Cabido et al. (2018).

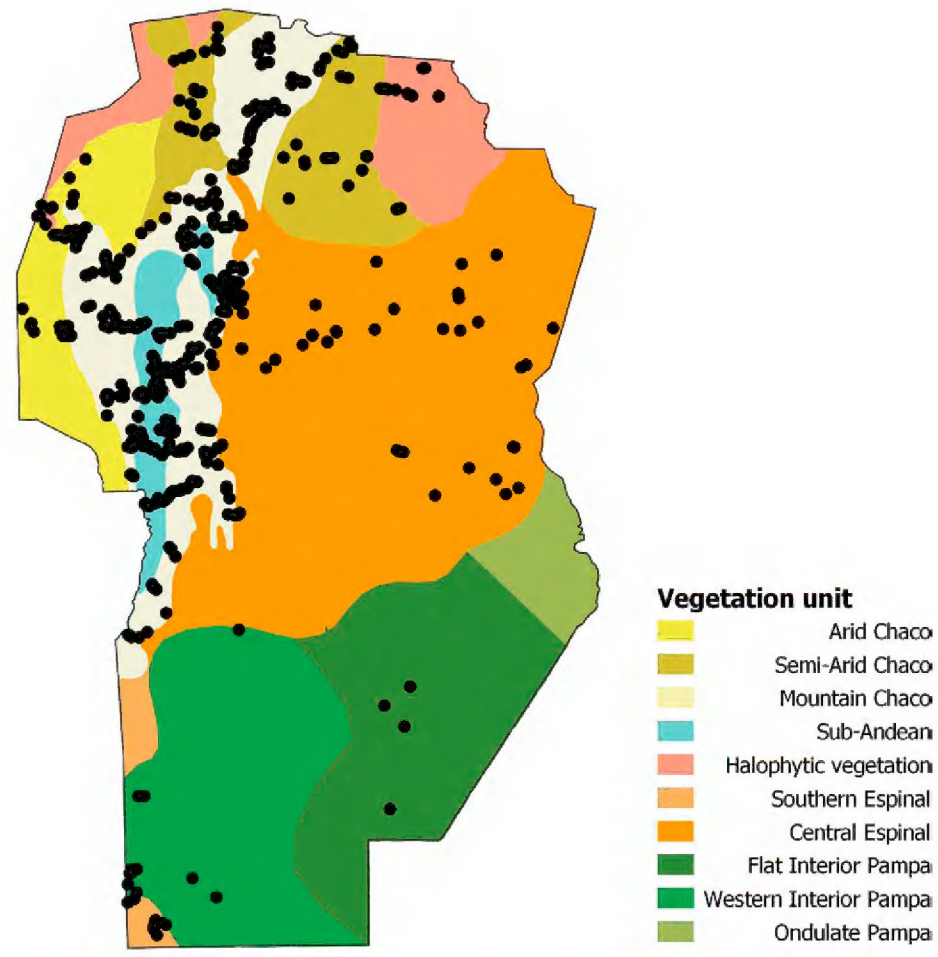

Figure 3. Distribution of the 1092 floristic surveys in the vegetation units across Córdoba province. Names were modified from Oyarzabal et al. (2018).

1.1. ***Arid Chaco.*** This unit is distributed in the northwestern and western plains, with approximately less than 500 mm of annual precipitation, and the vegetation exhibits a pronounced xeromorphy. The 6.4% of the vegetation plots of ArgVeg are located in this unit, mostly integrating the vegetation types described in Cabido et al. (2018) as *Larrea divaricata – Senegalia gilliesii – Mimozyganthus carinatus* subtropical xerophytic Chaco shrublands and woodlands. Also, a small subset of plots was used by Cabido et al. (1994) to describe shrubland and forest patches in this unit next to the mountain. Currently, the area is dominated mainly by shrublands and scrubs with scattered emergent trees and isolated medium to tall and closed to open woodlands (Hoyos et al. 2013) (Fig. 4A).

1.2. ***Semi-Arid Chaco.*** This unit is located in the northern lowlands, with annual precipitation ranging from 600 to 800 mm yr^{-1}. Currently, less than 20% of this unit is covered by an open to closed forest with several shrubs forming a high scrub or low tree stratum named in Cabido et al. (2018) as *Aspidosperma quebracho-blanco – Senegalia praecox – Ziziphus mistol* subtropical Chaco forest, represented in ArgVeg database by 4.8% of the vegetation plots. The rest of the unit is covered by agricultural lands which were converted from forest to crops mainly in the last three centuries (Hoyos et al. 2013).

1.3. ***Mountain Chaco.*** Located in the mountain area ranging from about 500 m to approximately 1,700 m a.s.l (Fig. 1C). 48.2% of the vegetation plots included in the database are located in this unit, and samples are classified and described in detail in Giorgis et al. (2017). Subsets of these plots were used by Zeballos et al. (2021) to describe patches with the presence

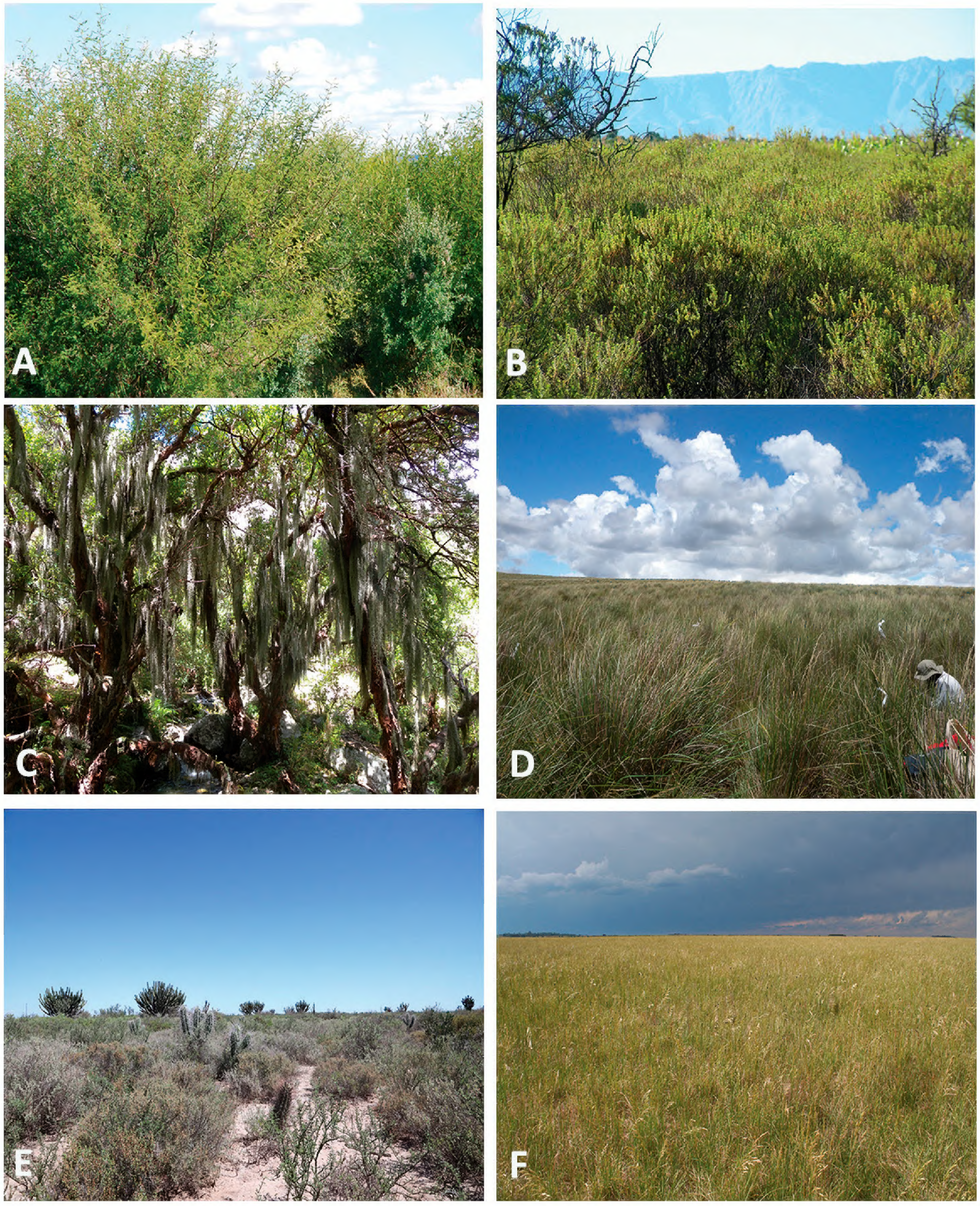

Figure 4. Examples of some vegetation types of the ArgVeg database. A) shrubland of *Vachellia aroma* in the Arid Chaco vegetation unit; B) shrubland of *Baccharis aliena* in the Mountain Chaco vegetation unit; C) forest of *Polylepis australis* in the Sub-Andean vegetation unit; D) grassland of *Poa stuckertii* in the Sub-Andean vegetation unit; E) shrubland of *Atriplex argentina* and *Allenrolfea* spp. in the Halophytic vegetation unit; F) grassland of *Bromus auleticus* and *Nassella* spp. in the Flat Interior Pampa vegetation unit.

of the palm tree *Trithrinax campestris*, by Cabido et al. (1994) to describe shrubland and forest patches in the western mountain extreme and by Acosta et al. (1991) to describe grassland communities at 1,400 m a.s.l. The landscape of this unit is a complex mosaic of native forests, shrublands and grasslands, with sectors covered by non-native forests and shrublands. In the lower part of the mountain area, this mosaic is formed mainly by crops, urban areas, and shrublands, while in the upper part grasslands

predominate, with low cover of shrublands and forests (Cingolani et al. 2022) (Fig. 4B).

1.4. ***Sub-Andean.*** Located from approximately 1,700 m a.s.l. to the upper part of the mountains at 2,770 m a.s.l (Fig. 1C). 30.5% of the vegetation plots included in the database are located in this unit. Some of these plots were used to describe the native shrublands and forests with *Polylepis australis* by Cabido et al. (2018), while others have not yet been published. The landscape is dominated by a complex mosaic of grasslands and rocky outcrops with some grazing lawns and few native shrublands and forests with *Polylepis australis* (Fig. 4C, D). This mosaic changes along the elevational gradient mainly with a reduction in the area covered by native forests and an increase in grazing lawns (Cingolani et al. 2022).

1.5. ***Halophytic vegetation.*** This unit includes saline depressions located in the northeast and northwest of the Córdoba province. This unit is dominated by azonal halophytic vegetation types including succulent shrublands and scrubs. This unit includes 1.2% of the database plots, which were published in Cabido et al. (2018) as the type: *Atriplex argentina – Cyclolepis genistoides – Maytenus vitis-idaea* halophytic/sub-halophytic shrubland (Fig. 4E).

2. **Espinal.** This phytogeographic province is located in the central, eastern and southern lowlands of Córdoba, in which forests and savannas dominated by *Prosopis* tree species are the potential vegetation type (Oyarzabal et al. 2018). 88% of the area was replaced by soybean and corn crops as well as grazing lands (Zak et al. 2019), while the natural and semi-natural woody vegetation types have been reduced to small and isolated patches and are threatened by the invasion of woody non-native species such as *Ligustrum lucidum* (Noy-Meir et al. 2012). The woody vegetation types of the Espinal are described in Zeballos et al. (2020).

   2.1. ***Southern Espinal.*** One percent of the vegetation plots in the database correspond to this unit and are described in Zeballos et al. (2020) as *Prosopis caldenia* forest.

   2.2. ***Central Espinal.*** The 6.3% of the vegetation plots included in the database were collected in the remaining woody patches and are dominated by the low open forest of *Geoffroea decorticans* (see Zeballos et al. 2020, for further information about the dynamics of this vegetation). Additionally, vegetation patches with the presence of the palm tree *Trithrinax campestris* are described by Zeballos et al. (2021)

3. **Pampean.** Located in the southeast lowland of Córdoba, this area was previously dominated by temperate grasslands but currently 92% are covered by crops (Zak et al. 2019). The dramatic transformation of the Pampean grasslands together with the advance of non-native invasive species of grasses (e.g. *Festuca arundinacea*, Tognetti and Chaneton 2012) and woody species (e.g. *Gleditsia triacanthos*, Chaneton et al. 2012) make the understanding of the dynamics and conservation of the Pampas grasslands an important further challenge.

   3.1. ***Flat Interior Pampa.*** 0.4% of the database plots are located in this vegetation unit and have not been published yet. Oyarzabal et al. (2018) defined two grassland communities, one dominated by *Poa ligularis*, *Nassella tenuisima*, *Nassella trichotoma* and *Eragrostis lugens* and the other dominated by *Distichlis spp.*, *Hordeum pusillum* and *Leptochloa fusca*. Additionally, Cantero and León (1999) described the plant communities of the inland salt marshes located in this unit and in the next one (Fig. 4F).

   3.2. ***Western Interior Pampa.*** 1.3% of the database plots are located in this vegetation unit and have not been published yet. This unit is characterized by grasslands dominated by *Sorghastrum pellitum* and *Elionurus muticus* (Oyarzabal et al. 2018).

Applications and future perspectives

The information derived from this database gives an overall description of the diversity of the current vegetation types in central Argentina, and thereby may represent a key tool for nature conservation in this region. As most of vegetation plots include geographic coordinates, they could be useful for combined analyses including ancillary information such as environmental data or protected area distribution. In addition, some plots are located in remnants of natural or semi-natural vegetation in one of the most threatened areas in Argentina (for example, the Espinal and the Pampean phytogeographic provinces, Cabido et al. 2018; Zeballos et al. 2020) and therefore represent a key element not only for restoration planning and conservation, but also for long-term vegetation monitoring.

We are planning to expand the geographic extent in the future and to increase the number of plots in poorly represented areas (e.g. non-native woody types, riparian vegetation, and Pampean grasslands) and important azonal types (e.g. vegetation of rivers and lakes). Additionally, we are planning to include further published floristic plots (e.g. Cantero and León 1999; Cantero et al. 2001) in order to provide a wide and comprehensive overview of all major vegetation types present in central Argentina.

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